Logistics Management Institute

Concept of Operations for AIT in an Automated Maintenance Environment for Army Weapon Systems

Volume 1

AR130T1

March 2002

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LMI®

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
03-2002	Final	

4. TITLE AND SUBTITLE
Concept of Operations for AIT in an Automated Maintenance Environment for Army Weapon Systems Volume 1

5a. CONTRACT NUMBER
GS-23F-9737H
DAAH10-01-F-0006

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Durant, Ronald W; Author
Thompson, Owen R.; Co-Author

5d. PROJECT NUMBER

5e. TASK NUMBER
AR130

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Logistics Management Institute
2000 Corporate Ridge
McLean, VA 22102-7805

8. PERFORMING ORGANIZATION REPORT NUMBER
AR130T1

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Aviation Applied Technology Directorate
Development & Engineering Center (AMCOM)
Ft. Eustis, VA 23604-5577

10. SPONSOR/MONITOR'S ACRONYM(S)
USAATCOM TR 02-D-13

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
A Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
Concept of operations for Army weapon systems using AIT in order to facilitate enhanced maintenance processes, weapon system support, component life-cycle management, and an accurate assessment of individual or collective unit mission readiness.

15. SUBJECT TERMS
automatic identification technologies; tasked based maintenance processes; go-to-war-capability assessment; automated maintenance system; automated information system

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Nancy E. Handy
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	Unclassified Unlimited	22	19b. TELEPHONE NUMBER *(include area code)* 703-917-7249

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Foreword

The companion volume (Volume 2) to this executive summary contains the comprehensive Concept of Operations for AIT in an automated maintenance environment for Army weapon systems, with several illustrative scenarios.

Executive Summary

Reducing the Army logistics structure is essential to Army plans for transforming itself into a rapid, lean, and deployable force. Simply stated, the Army must transform its current logistics processes in order to reduce logistics requirements and better facilitate Army transformation.

A large portion of the current Army logistics requirements and organization structure is dedicated to maintenance functions. Subsequently, the success of transforming Army logistics relies heavily on their ability to reduce maintenance requirements and processes. Current Army maintenance processes were established decades ago—when manpower was more robust and business was conducted at the speed that paper could be transacted through the system. Therefore, in order to achieve greater maintenance efficiency, and to fulfill its overall transformation goals and reduce logistics requirements, the Army must reengineer its maintenance system.

The *Concept of Operations for AIT in an Automated Maintenance Environment for Army Weapon Systems, Volume 2,* (hereafter called the Con-Ops [Vol. 2]) presents a new paradigm of logistics functionality that achieves significant reductions in maintenance processes and requirements. Moreover, through its optimal use of automation, new technologies, and maintenance process reengineering, the Con-Ops presents a corresponding reduction in overall logistics processes and requirements.

This reduction in maintenance processes equates to a potential increase in maintenance productivity. Improving maintenance, while simultaneously increasing maintenance productivity, delivers a potential reduction in overall logistics support requirements. Changes made in one logistics functional area will affect other processes in other logistics functional areas. Therefore, in looking to improve the Army maintenance system, new processes cannot be confined to old functional boundaries.

In assessing the right development approach to a new maintenance system, the Con-Ops team studied various combinations of digital information systems, new technology, and process reengineering. The most applicable combination of technology and information software were then selected to enable innovative, yet achievable, changes to maintenance process. In turn, these changes affect the overall logistics system. The results of these changes are portrayed in the Con-Ops (Vol. 2).

THE CON-OPS METHODOLOGY

The Con-Ops uses a typical Army aviation weapon system, which is represented by the CH-47 helicopter and its support structure. The Con-Ops is not exclusive to either the CH-47 or aviation. However, the CH-47 provided the Con-Ops team a model with both a legacy weapons platform as well as a modernized one—thanks to the emergence of the modernized CH-47F helicopter. This provided access to a broader range of implementation issues. The CH–47 viably demonstrates the challenges of establishing an automatic identification technology (AIT)–enabled maintenance system and forms a tangible foundation for the Con-Ops approach.

The Con-Ops' approach to maintenance was modeled after an ordinary, yet comprehensive, maintenance requirement for the CH-47 helicopter. The Con-Ops team selected this specific maintenance requirement as it represented the full spectrum of activity encountered in a typical maintenance event. The team researched this single requirement to establish a baseline of activities and processes for comparison. The requirement was then applied to three proposed phases of a notional implementation program—via scenarios—using the Con-Ops. This method accurately characterized the effects of the Con-Ops at all levels of activity through the various phases of the notional implementation.

A baseline of activities was established at the beginning phase of this notional implementation program. The maintenance requirement selected was the removal of a major, flight-critical assembly for routine servicing and inspection. The maintenance requirement was broken out into four categories:

- *Processes*—those major events necessary to plan, initiate, conduct, and conclude the maintenance requirement (e.g., production control procedures, quality control procedures, aircraft induction procedures).
- *Maintenance actions*—the tasks necessary to perform and complete the maintenance requirement (e.g., remove cowling, measure inside diameter of part).
- *Supply actions*—those actions that require a direct interface with the point of supply or supply processes (e.g., initiating a supply requisition, receiving a part).
- *Manual data entries*—any task or action that requires an entry onto a paper form or an input into an electronic system to capture the data necessary to plan, initiate, conduct, or conclude the maintenance requirement.

BENEFITS

Using the approach developed in the Con-Ops (Vo. 2), there was a potential for a 19 percent reduction in the maintenance requirements associated maintenance

processes, as portrayed in Table ES-1. Likewise, a 49 percent reduction in associated maintenance actions appears possible. The potential reduction in supply actions was assessed at 97 percent, and there was a potential 100 percent elimination of manual data entries.

Table ES-1. Potential Changes to Maintenance Activities

	Processes	Manual data entries	Maintenance actions	Supply actions
Inception state (baseline)				
Flight-line Activity	5	120	550	50
Intermediate maintenance activity	5	57	77	4
Depot activity	15	120	250	4
Command activity	4	10		
Sustainment base activity	3	114		
Inception state subtotals	32	421	877	58
Objective state				
Flight-line activity	3	0	200	2
Depot activity	12	0	250	
Command activity	8	0		
Sustainment base activity	3	0		
Objective state subtotals	26	0	450	2

With the Con-Ops-developed approach, these results equate to a one-fifth reduction in the selected CH-47 maintenance requirement's supporting tasks. The time required to complete the reduced task workload (i.e., man-hours) was reduced by about half from the established baseline activities. Although the results only represent potential reductions if applied to the entire fleet of CH-47 helicopters, we can start to develop a sense of just how relevant maintenance system reengineering is to Army transformation.

In addition to the reduction in maintenance processes and requirements, the Con-Ops presents many other potential benefits. These apply to other logistics functional areas, which range from weapon systems management to disposal and reutilization management. Benefits extend to Army operations and mission planning as well.

Through precise component configuration management enabled by AIT at the weapon system—and the ability of the digital information system to associate relevant history of use and maintenance data to a specific component—a predictive ability regarding weapon system support requirements is established. This benefit correlates into enhanced combat sustainability for the combat commander and users of the weapon system.

DESCRIPTION AND PURPOSE

The Con-Ops is a conceptual description of how AIT establishes a new paradigm for weapon system management through an automated maintenance environment (AME). The Con-Ops describes how the AME, with its improved and reengineered processes, is deployed for operational use within the Army. It also defines how AIT:

- is technically necessary and integral to the AME;
- attains the full management capability within the AME;
- enables new, automated processes that are implemented at all echelons of maintenance to improve overall logistics performance; and
- facilitates improved weapon system support and enhanced mission effectiveness.

The Army goals regarding maintenance AIT are outlined in the Army's G-4 vision document, *Maintenance Automatic Identification Technology: The Vision* (December 2000). These goals are more comprehensively defined in the *Maintenance AIT Implementation Plan* (currently being staffed at the Department of the Army level). The Con-Ops provides a conceptual bridge for the Army to coherently move maintenance AIT from vision to full implementation. Essentially, the Con-Ops' purpose is threefold:

- *Communicate innovation.* Foremost, the Con-Ops serves as a medium for communicating innovative and practical approaches to maintenance and weapon system management, which is applicable to both aviation and ground-based weapon systems, and is fully enabled by AIT.
- *Implementation guide.* The Con-Ops also serves as a guide for anyone charged with the implementation of AIT for an Army weapon system—or for those involved with the development of automated logistics and business systems.
- *Catalyst for action.* Finally, using operational scenarios, technical discussion, and business analysis, the document can serve as a catalyst for consensus on the optimal approach to the development, support, and use of AIT within maintenance processes and their subsequent integration into Army automated logistics.

TECHNICAL ASPECTS

The Con-Ops approach to maintenance centers on the ability to uniquely and accurately identify critical items within the maintenance processes and the overall logistics system. This ability is provided through the effective use of AIT in

association with an automated information system (AIS). The role of the AIS is to automatically pass, process, and present relevant data into useful information. How this information is then used, and how it integrates into the total logistics system, is defined in the context of the new automated maintenance environment.

The AME

The term, AME, is applied to an integrated, automated information and maintenance management system (with all its associated procedures, processes, and techniques) used in the total management and support of Army weapon systems. The AME is not a "system" per se; it is the aggregation of various capabilities throughout the operational environment.

To understand the concept behind the AME, we must understand the technical relationship between AIT and the AIS to which it is linked. This relationship is complex when viewed from a total enterprise perspective. It consists of the technical architecture and the technical requirements of both the AIS and its supporting AIT. The Con-Ops-developed approach characterizes this relationship as well as the data requirements and the total data flow within the AIS (from weapon system to the business enterprise). Moreover, this approach focuses on the technical aspects of automated maintenance management relative to the environment within which maintenance operations are conducted.

The AIS

The AIS is the digital information system that supports data transfer and information management processes necessary to conduct Army logistics and operations. The AIS is emerging within the Global Combat Support System–Army (GCSS-A) and the Wholesale Logistics Modernization Program (WLMP).

The whole premise of the AME is based upon the use of data. The AIS provides the reference set and controlling functions for that data. Early identification, capture, and population of source data is critical to the effective implementation of the AIS. Therefore, the AIS is dependent upon automated data acquisition, which is enabled by AIT.

The ability to uniquely identify an item within the AME, as well as within the overall enterprise, is critical to the AIS if it is to successfully automate and manage maintenance operations and weapon system support. The Con-Ops further describes both the purpose and the method of unique item identification within the AME and the total logistics system.

The AMS

The automated maintenance system (AMS) is a subset of the AIS. It is the digital information system designed to serve the specific functions and processes for weapon system maintenance and maintenance management. The current forms of

the AMS are the Unit-level Logistics System (ULLS) and Standard Army Maintenance System (SAMS).

As a component of the AIS, the AMS' design is critical to the effectiveness of the AME. The AMS is the maintenance management program for all weapon system maintenance functions, including logbook functionality. The AMS can be operated independent of the AIS only for a limited duration. The AMS' integration into the AIS is optimized through several key features: task-based maintenance, integrated-interactive technical data, and unique item identification (automatically acquired through the use of AIT).

AIT

Automatic identification technology is essential in the acquisition of accurate data for the AIS and is essential in fully enabling automated processes and functions within the AME. Therefore, the type of AIT selected for use in the AME is critically relevant to the data handling characteristics of the AIS. Furthermore, the selection of AIT used within the AME must be compatible with, and serve the majority of processes within, the overall logistics system. In the Con-Ops (Vo. 2), the selection criteria of AIT are defined, as are suitable methods of parts marking. The Con-Ops also addresses standardization of AIT and AIT data.

Standardized unique item identification is paramount to the ability of the AME, the Army, and the DoD business and management systems to effectively manage assets and processes. However, the Con-Ops team realizes that the needs of all potential users of AIT cannot be achieved by a single technology. Therefore, the concept of a prime technology and supplementary technologies is introduced and used to achieve commonality and consistency, both across business areas and with vendors.

OPERATIONAL ASPECTS

The AME consist of information from other logistics functional areas and is dependent upon the flow of that information. However, these functional areas are redefined by restructured processes critical to Army business and mission operations. This creates the ability within the Con-Ops to seamlessly integrate today's diverse functional processes to serve new and automated processes of maintenance and weapon system support.

For example, the AME combines daily maintenance management processes with enterprise-level supply management functions, which allows the operational commander an accurate forecast of weapon system availability for any given mission or point in time. By linking certain logistic and business functions with specific mission requirements within the AME, the Con-Ops (Vol. 2) demonstrates the potential enhancement to weapon system support and combat sustainment capability.

The AME creates an automated maintenance operation and enhances weapon system support using the following unique features:

- Task-based maintenance management
- Integrated-interactive electronic technical data
- Item total life cycle management
- Go-to-war capability (GTWC) assessment.

The Con-Ops (Vol. 2) explains how the AME is created both from the application of technology and through process reengineering and maintenance management. This creates a new paradigm in weapon system support. The paragraphs below provide a synopsis of the features of this new paradigm.

Tasked-Based Maintenance

Currently, Army maintenance is derived from fault-based maintenance procedures. This means all maintenance actions are associated to the originating fault. Faults are not standardized nor are they particularly accurate indicators of what has really happened to create a malfunction indicator. Task-based maintenance is different in that it automatically associates a fault to a specifically numbered maintenance task. As all maintenance tasks are numbered, and all work is assigned by task, all procedures performed against that task are automatically and invisibly tracked against the originating task number. This association accurately associates the cause, effect, and corrective action of all faults. It also captures the relevant historical data associated with any maintenance action on any tracked component. The AME benefits as trend analysis is enabled for individual components, sub-systems, or systems that are uniquely identified through the use of AIT and tracked by maintenance task.

Integrated Technical Data

The Con-Ops' new task-based approach to maintenance is made possible through interactive integrated electronic technical data. Integrated, interactive technical data differ from just "interactive data," in that all required data are fully incorporated into the AMS and presented on demand on a single display. There are no extra steps to distract the mechanics, who otherwise would continually leave and reenter the AMS from (or to) another electronic medium. Technical data are integral to optimizing the AMS for the user and provides linking data required throughout the AME. Technical data consist of everything from weapon system configurations to advisories on new maintenance procedures, to supply information. Likewise, technical data are automatically updated at the AMS whenever necessary—no mechanic intervention is required.

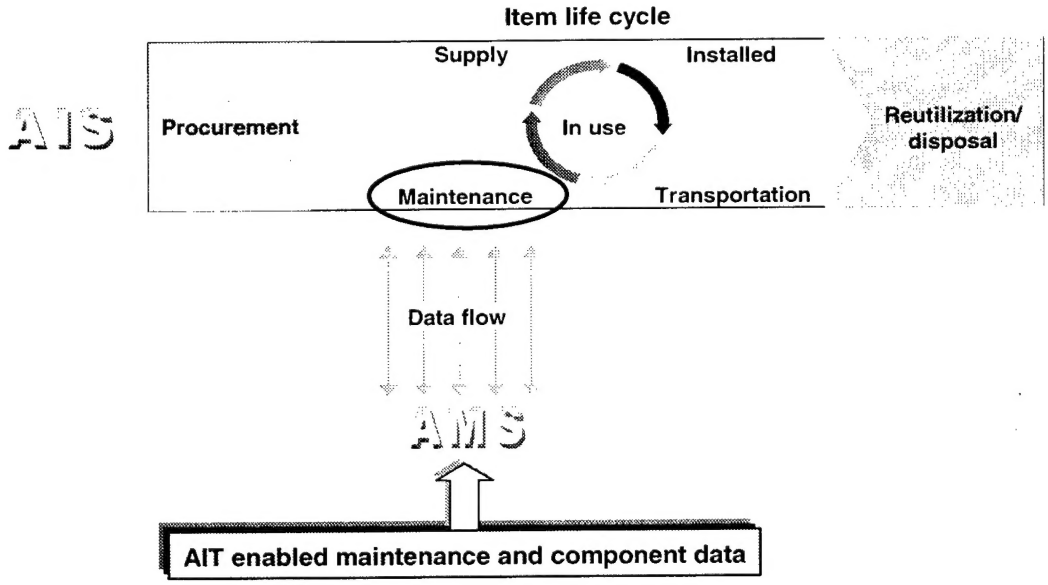
Item Total Life-Cycle Management

Select components or systems are fully visible within the AME and the overall logistics system. Immediate access to the item's specific maintenance and use history, which is enabled by AIT, allows the item manager to accurately identify all issues regarding that component or family of components. The ability to understand the exact circumstances of a component's use provides information for failure trends.

"Bad actor" components are identified and removed from service, which increases repair productivity. Reliability reengineering and modifications are accurately applied to mitigate failure trends and increase component service life. The true costs of operation and support are visible and understood. Cost reduction strategies are applied but can be correctly measured against performance standards. Consequently, logistics requirements are reduced through effective support solutions and efficient asset and maintenance management.

The life cycle of an item (component or system) includes the stages illustrated in Figure ES-1, which take a component through its entire life from manufacture to disposal.

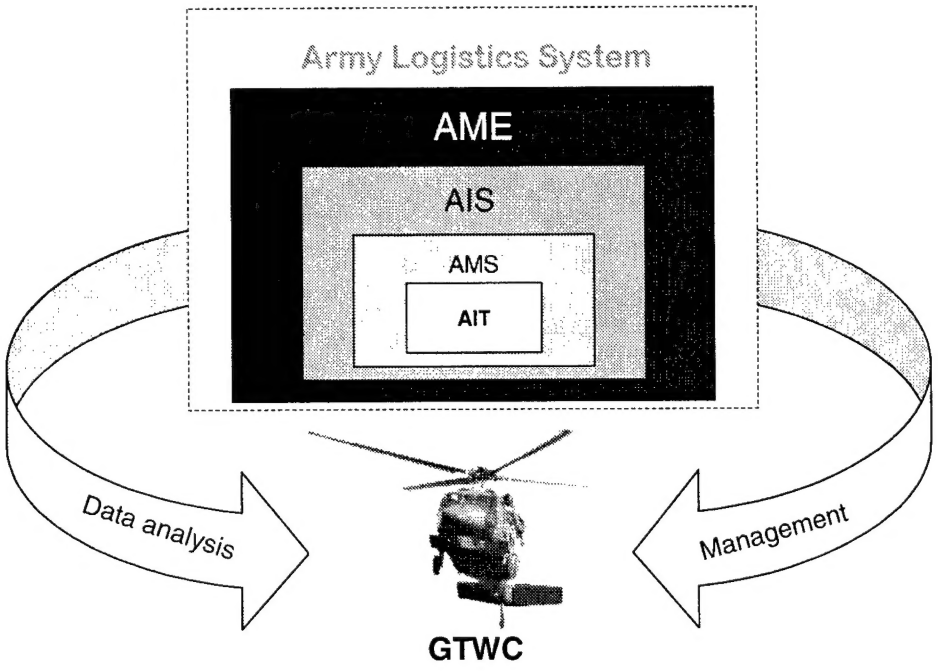
Figure ES-1. Item Total Life-Cycle Flow



GTWC Assessment

Figure ES-2 demonstrates the relationship and position of the respective components of the AME. All of these contribute to the holistic AME, which in turn enables the accurate assessment of the GTWC for the operational commander.

Figure ES-2. The Automated Maintenance Environment



The GTWC assessment is the ultimate benefit delivered by the AME to the operational commanders. It brings to bear the full capability of the AMS and the AIS for automated maintenance management and weapon system support. The features presented in the Con-Ops enable this assessment capability. These features reside in the AMS and the AIS, and are enabled through the combination of AIT, electronic task-based maintenance, integrated-interactive technical data, and total life-cycle management processes. This capability allows the operation commanders to accurately assess what it takes to successfully support and sustain any mission. Predictive and anticipatory logistics are accurately applied to a specific unit, weapon system, or to the specific mission assigned. The commander can plan the mission based on the expected combat availability of his unit for any projected time, and under any conditions.

CONCEPT RESULTS

The AME approach to maintenance management, which is characterized within the Con-Ops, achieves a significant reduction in maintenance processes. It also describes potential enhancements to weapon system support, which decreases overall logistics requirements. The reduction in maintenance processes directly translates to an increase in maintenance productivity. Likewise, enhanced weapon system support translates into increased combat sustainability; decreased logistics requirements translate to reductions in overall mission support requirements. Consequently, through use of an AIT-enabled AME, the Army is able to achieve its

transformation goals: reducing its logistic footprint and developing a rapid, lean, and deployable force.

As combat sustainment capability increases, it directly translates to a potential increase in combat availability (in both personnel and weapon systems). If applied to the entire fleet of CH-47 aircraft, or any other weapon systems, the gains are exponentially expanded. This affords the Army an opportunity for unprecedented advancement in the revolution in military logistics and facilitates the Army transformation efforts.

The Con-Ops describes how, through the development and application of AIT, the Army has an opportunity to reengineer its maintenance system. AIT is not by itself a panacea for current Army logistics inefficiencies, however. AIT is only a means to enable automated data acquisition to establish data accuracy. Only when AIT is coupled with the AMS, which is integrated into the AIS, does a new paradigm evolve regarding logistics management and weapon system support.